

Kaufman - Trading Systems & Methods - Chap05

Chap05

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5 Trend Systems

The previous chapter developed the tools for calculating trends a standard moving average, weighted averages, exponential smoothing, and regression-based values. To profit from identifying the trend requires the use of trading rules and the selection of specific parameters that define the trend speed and position risk, among other factors. Often, the selection of rules is seen to be dependent on additional parameters. This chapter will first discuss those rules that are necessary to all trading strategies, then give examples of actual systems. The selection of trend speed is handled only briefly here, but it is continued with a detailed analysis of these and other systems throughout the book, and especially in Chapter 21 ("Testing"). Toward the end of this chapter, a section on viewing sequences of trends may prove interesting to the analyst trying to be more innovative.

BASIC BUY AND SELL SIGNALS

Regardless of the selection of moving averages, the smoothed trend calculation will lag behind the actual current market price. In rising markets, this lag will cause the moving average to be below the price; in falling markets, it will be above. When prices change direction, the trendline and the actual market prices cross because the trend is slow to reflect the new market direction. These crossings provide the opportunity for the basic trading signals

Buy when rising prices cross the trendline.

Sell when declining prices cross the trendline.

It is also necessary to decide what prices are to be used. The answer depends on the construction of the average and the testing of the system. If the average is composed only of closing prices, it is reasonable to start testing with the modified signals

Buy when rising prices close above the trendline.

Sell when declining prices close below the trendline.

If an average of high and low prices were used, or the high, low, and close, a buy or sell would be signaled when the new average $(\text{high} + \text{low})/2$ or $(\text{high} + \text{low} + \text{close})/3$ was above or below the corresponding moving average value. In all cases, consistency is important. The system that is tested and the one that is traded should be the same. In the following discussion, the term close will be used. To find out if a trading signal occurred on any day, wait until the close of trading, calculate the new moving average or trend value, and then see whether a crossing occurred according to the basic buy and sell rules.

You may have realized that using the closing price to generate a signal usually requires that calculations occur after the market has closed, and orders must be placed in the afterhours market or on the next day's open. If the system is actually generating signals as of the closing price, then you are not following the system. To correct this problem, the value of the closing price that would cause a new signal should be calculated in advance. This would allow execution on or near the close of the current day. The rules of the system can also be changed to buy or sell on today's close if that price is above or below yesterday's

moving average value. A small amount of testing will determine which approach works best. Another choice would be to test today's close against yesterday's projected moving average; therefore, if the moving average values for the past 2 days were $M_{t-1} = 432$ and $M_{t-2} = 429$, the difference $M_{t-1} - M_{t-2}$ would be added to M_{t-1} to get the estimated turning criterion of M_t for today. That means that the *rate of change* must differ for a signal to occur. More sophisticated approaches to projecting the moving average will be covered later.

Variations in Timing

Lead and *lag* are features common to the trend opposite in purpose, a lead of n days advances the moving average M_t from the same time as the current. In actual trading, this gives an advance criterion above this level to maintain the current position. The moving average value at the same time as P_{t-n} , has already occurred, but no action may be taken to anticipate a trend change, while a lag is a commitment. Both techniques may use the same basic buy and sell

Entry and exit timing may be improved by a delay from 1 to 3 days. This technique allows a number of reversals to occur and show a *false signal* at the cost of more losses. Markets that have a large number of short-lived losing trades may fit from a delay of 1, 2, or 3 days.

Reversing a position on each trade signal results in a high loss rate in the market. This philosophy will show greater losses and more frequent losses because of the constant counter-trend saw periods. An entry delay may also improve a

BANDS AND CHANNELS

Thus far, modifications have been based on a simple moving average or trendline. The plot can be adjusted forward or backward, the position can be reversed, or the entry or exit delayed in an attempt to begin the new trade at the time when the trend has decidedly taken a new direction. Even if prices have begun what will become a major downtrend, an entry into a short position too soon may be subjected to sharp reversals caused by conflicting fundamental and technical elements at these turning points. The simplest way to avoid these price variations is by using a band.

A band is an area surrounding a trendline above and below that acts as a zone of commitment for the trader and allows time, as measured by price movement and risk, for prices to settle into their new direction. Also called channels, bands can be created in many ways, one of the most popular being a percentage of the current price or the current trendline value. A band that is formed from the trendline will be

$$\text{(upper band)} \quad B_U = M_t + cM_t$$

$$\text{(lower band)} \quad B_L = M_t - cM_t$$

where c is a percentage, $0 \leq c \leq 1$, and M_t is today's moving average is much smoother than the price path. well. If the current price is used instead of the moving

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$$B_U = M_t + cP_t$$

$$B_L = M_t - cP_t$$

The band will vary in width at a much faster rate using price. During an uptrend, the band based on prices can get very wide. Another popular type of band is based on absolute point value, for example, silver 50, corn 50, or cattle 25 points; each represents a dollar risk to the trader. The use of this type of band is usually found coordinated with a money management program that limits losses on trades to a specific number or to a maximum percentage of the portfolio being managed.

The independent smoothing of the high and low prices for any period forms a volatility band. Although it may be practical to use the same technique or the same relative smoothing (e.g., 10day or 10% smoothing constant) for the high, low, and closing prices, it is not a requirement. if the same smoothing criterion is used, the band will be uniform with respect to the moving average of the closing price; if not, all three trendlines may weave around one another. A volatility function can also be used to create a band. Rather than the simple percentage calculation shown first, the band may be increased at rates equal to a pricevolatility relationship. All of the methods of forming bands are subject to scaling. Scaling is accomplished using a value as a multiplier or scaling factor; it will increase or reduce the sensitivity of any technique used for calculating the band. if S is a scaling factor, then the following bands can be constructed:

$B = M_t \pm S \times c \times M_t$	(percentage sm
$B = M_t \pm S \times c \times P_t$	(percentage sm
$B = M_t \pm S \times R$	(fixed risk using
$B_U = S \times f(H_t) \}$ $B_L = S \times f(L_t) \}$	(independent sm
$B = M_t \pm S \times (H_t - L_t)$	(volatility of high
$B = M_t \pm S \times V(P_t)$	(volatility functio
$B = M_t \pm S \times V(M_t)$	(volatility at mov

When $S = 1$, the scaling effect is nullified; for $S > 1$, the width of the band is magnified; and for $S < 1$, the band is reduced.

Different bands are not mutually exclusive. A variable band may be used to time the entries and exits subject to a maximum risk established by another band. It may also be convenient to have separate exit and entry bands, the first more sensitive, such that a reversal of position is not always necessary. An exit band may be based on the intraday high or low prices while entries are determined by closing prices.

Bollinger Bands

Perhaps the simplest and most robust measurement of price volatility is the standard deviation of the prices themselves over recent price history. Originally introduced by John Bollinger and popularly called Bollinger bands, the value of 2 standard deviations of price movement over the past 20 periods are plotted above and below a 20day moving average. As with other techniques, the popularity of the computer has allowed users to change both the calculation period and the number of standard deviations that form the band. Because the standard deviation represents a confidence level, the choice of 2 standard deviations equates to a 95% confidence band, while 3 standard deviations give a confidence band of 99%.

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Another way of viewing Bollinger bands is as a percentage, seen as %b:

$\%b = (\text{Close} - \text{Lower band}) / (\text{Upper band} - \text{Lower band})$

In TradeStation, a function that returns the upper and lower generalized Bollinger bands, given the calculation period and standard deviation factor, is

```
{Function Bollinger_Band
```

```
Returns the width of the Bollinger band as mea
```

```
inputs:period(numeric), nsd(numeric);
```

```
Bollinger_Band = nsd * @stddev(close,period);
```

From the main program, the bands are created with the following instructions:

```
bandwidth = Bollinger_Band(period,r
```

```
highband = @average(close,period) +
```

```
lowband = @average(close,period) -
```

An excellent example of Bollinger bands uses a combination of weekly and daily data applied to the S&P 500, as seen in Figure 51. The price pattern follows the weekly Bollinger band higher, where the daily and weekly come together during the week of July 14.

Rules for Using Bands

Regardless of the type of band that is constructed, rules for using bands to generate trading signals are limited. The first decision to be made is whether a current position will be liquidated or reversed, causing the entry into a new position in the opposite direction. Assuming a reversal from long to short and from short to long, the following rules apply:

- Buy (close out shorts and go long) when the price penetrates (closes above) the upper band.

- Sell (close out longs and go short) when the price penetrates (closes below) the lower band.

This technique is always in the market with a maximum risk (without execution costs) equal to the width of the band at the time of entry (see Figure 52). If a neutral position is preferred after exiting from each trade, there are the alternative rules:

- Buy (go long) when prices penetrate the upper band. Close out longs when prices reverse and go below the moving average value (the center of the band).

- Sell (go short) when prices break below the lower band. Cover your shorts when

- prices penetrate upward through the moving average value.

The band is then used to enter into new long or short trades, and the actual trendline within the band is used only for liquidation. If prices are not strong enough to penetrate the opposite band on the close of the same day, the trade is closed out but not reversed. The next day, penetration of either the upper or lower band will signal a new long or short trade,

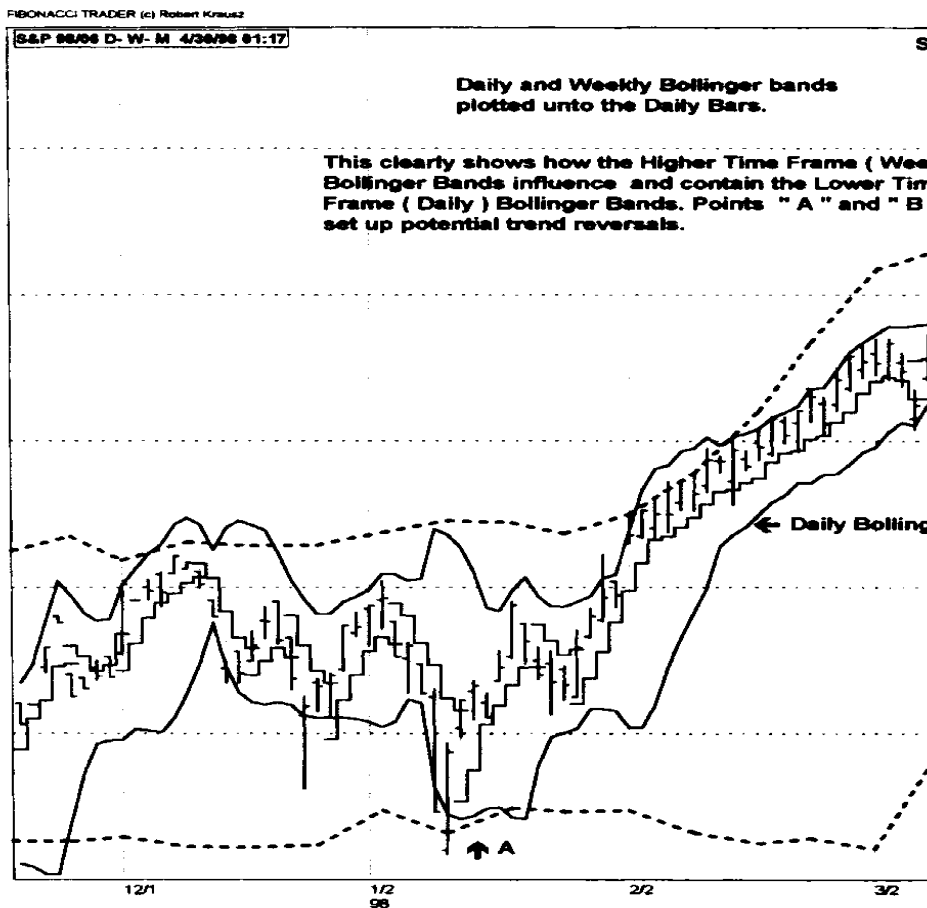
respectively.

This technique allows a trade to be reentered in the same direction in the event of a false breakout. If a pullback occurs after a closeout while no position is being held (as shown in Figure 53), an entry at a later date might be at a better price. A disadvantage occurs when the price changes direction and moves so fast that both the closeout and the new signal occur on the same day. Reversing the position immediately would be better in a fast market.

The high and low of the day may also be used as penetration criteria, Again, using the outer bands for entry and the moving average for exit, apply the following rules:

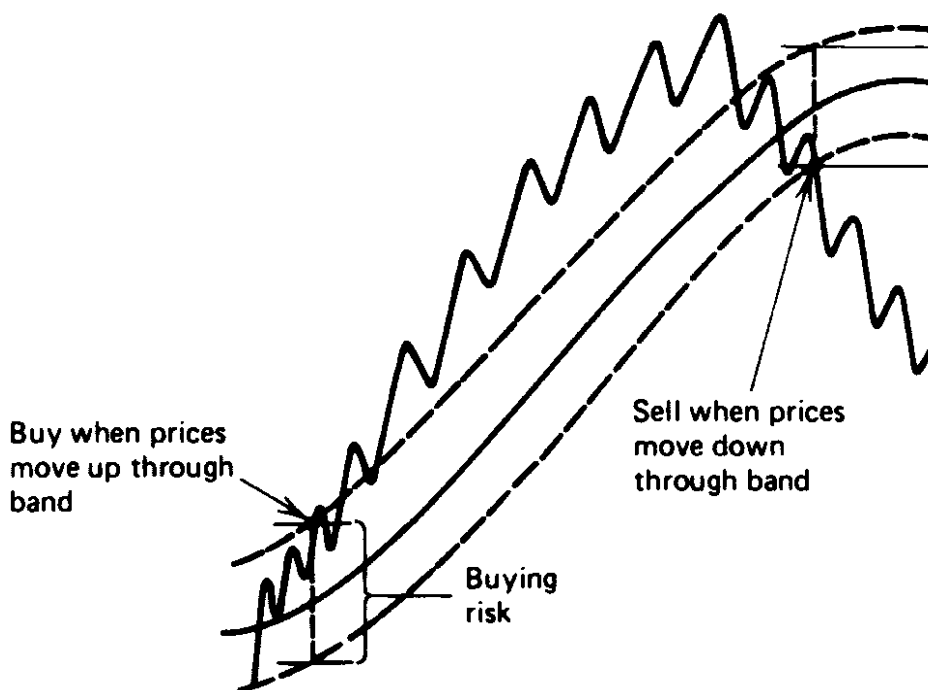
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FIGURE 51 Combining daily and weekly Bollinger bands.



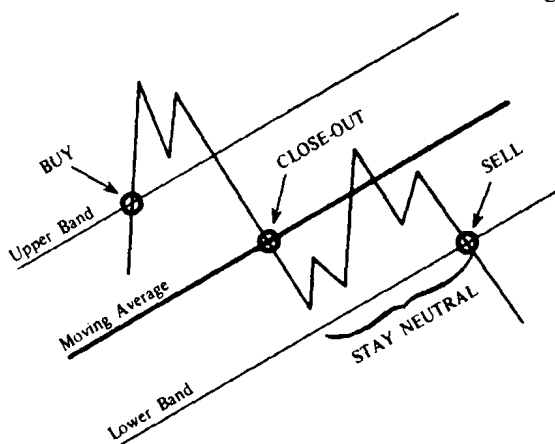
Source: Chart created using The Fibonacci Trader. Used with permission from Fibonacci Trader Corporation, 757 SE 17th Street, Suite 272, Ft. Lauderdale, FL 33316. www.fibonacci trader.com.

FIGURE 52 Simple trading rules for moving averages.



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FIGURE 53 Basic rules for using bands.



Buy when the high of the day penetrates the upper band, and close out longs when the low of the day penetrates the moving average. Sell when the low of the day penetrates the lower band, and cover shorts when the high penetrates the moving average.

With both the first and second set of rules, risk is limited to half of the full band width. In the second case, the chances of exiting one trade and

remaining neutral are greater than the first.

Timing the Order

The type of execution order placed when following a system will have a longterm effect on its results. The use of a band with a single moving average identifies change of trends when a breakout occurs. Buying during an upside break or selling during a downside break often results in poor entry prices, and has been known to place the trader in a new trend at the point where prices are ready for a technical adjustment. The most frequent complaint of trend followers is that their new positions usually show losses and that it takes a long time before the technical adjustment ends and the new trend returns to its entry price level. This reasoning has caused many variations from the original rules:

- Buy (or sell) on the close after an entry signal has been indicated.

- Buy (or sell) on the next market open following a signal.

- Buy (or sell) with a delay of 1, 2, or 3 days after the signal.

- Buy (or sell) after a price retracement of 50% (or some other value) following a signal.

- Buy (or sell) when prices move to within a specified risk relative to a stoploss point.

These modifications are for the purpose of entering a new position with an immediate profit or preventing excessive risk. Some can be categorized as timing and others as risk management. If intraday prices are used to signal new entries and exits, a rule may be added that states:

Only one order can be executed in one day either the liquidation of a current position or an entry into a new position.

The goal of improving exit and entry points is well worth spending time and effort. With limited capital, the conservation of the investment is important when the greater number

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of trades are expected to lose money. Better entry points will reduce the risk on a larger part of the trades and allow longer strings of poor performance.

Waiting for the right time to enter a trade may have more disadvantages than is apparent. In tests on trendfollowing systems conducted over many years, it can be shown that positions entered at the market opening on the day following the system signal improved fill prices about 75% of the time but resulted in smaller overall profits for the year. Why? Fast breakouts never adjusted back to allow the trader to enter at a better price. The three out of four better fills were more than offset by the one breakout that kept going.

APPLICATIONS OF SINGLE TRENDS

The selection of the trend speed (calculation period) is as important as any of the system's rules. The speed determines the activity of trading and the nature of the trend to be isolated. To help this decision, some of the preceding sections have shown comparisons of the different speeds as well as approaches, based on minimizing the magnitude of the forecast errors. Without a computer, extensive examination of alternatives is impossible. Chapter 21 concentrates on the use of the computer for selection of trend

speed and risk parameters for single and multiple trend systems, as well as breakout systems. It also includes an analysis of results.

Prior to being able to optimize, the trend period was based on multiples of calendar periods, expressed as trading days. In doing this, there is an opportunity to be in phase with behavioral patterns of traders and brokerage houses, who may work within weekly or monthly spans. The most popular intervals for selection have been 3 days, the expected duration of a short price move; 5 days, a trading week; 20 to 23 days, a trading month, and so on. Included in the next sections are well-known systems using single trends, followed by examples of multiple trend systems.

MPTD1 (A Step Weighted Moving Average)

In 1972, Robert Joel Taylor published a system called the "Major Price Trend Directional Indicator" (MPTDI), which was reprinted in summary form in the September 1973 issue of *Commodities Magazine*. The system was promoted and implemented through Enterex Commodities in Dallas and was tested in 1972 on historical data by Durin and Hargitt Financial Services in West Lafayette, Indiana. It was one of the few well-defined published systems, and it served as the basis for much experimentation for current technicians and aspiring analysts.

MPTDI is based on a step-weighted moving average of varying lengths, with a band of changing widths relative to volatility. It is unique in its complete dependence on incremental values for all aspects of the system: the moving average, entry, and stoploss points. For example, Table 51 shows what conditions might be assigned to gold.

If gold were trading in an average range of 250 to 350 points each day, the weighting factor for the moving average would be TYPE C, indicating medium volatility (TYPE A is lowest). Using TYPE C with a 15-day moving average, the most recent 5 days are given the weight 3, the next 5 days 2, and the last 5 days are weighted by 1. The buy and sell signals use the corresponding entry signal penetration of 250 points above the moving average as a buy signal and 250 below as a sell entry. The highs or lows of intraday trading are used to activate the entry based on values calculated after the close of trading on the prior day. A stoploss point is fixed at the time of entry equal to the value on the same line as the proper volatility. The penetration of the stoploss will cause the liquidation of the current trade. A new signal in the reverse direction will serve as both a stoploss and reentry point.

<i>Average Trading Range</i>	<i>Number of Days in Calculation</i>	<i>Weighting Factors Progression</i>	<i>Entry Signal Penetration</i>
50-150	25 days	TYPE A	100
150-250	20 days	TYPE B	200
250-350	15 days	TYPE C	250
350-450	10 days	TYPE D	350
450+	5 days	TYPE E	450

*100 points = \$1 per ounce.

There is a lot to say in favor of the principles of MPTD1. It is individualized with respect to markets and selfadjusting with changing volatility. The stoploss serves to limit the initial risk of the trade and allow the coordination of a money management approach. The fixed risk differs from moving averages using standard bands, because a moving average and its band can back away from systementry points on a gradual reversal of the price trend. But there are some rough edges to the system. The incremental ranges for volatility, entry points, and stops seem a crude measure. Even if they are accurate in the center of the range, they must get doubtful at the extremes at the point of change from one range to another. Analysts will find that they may need to study price movement at discrete levels, such as those shown in MPTD1, to be able to generalize a price or volatility pattern.

The Volatility System

Another method that includes volatility and is computationally simple is the Volatility System.' Signals are generated when a price change is accompanied by an unusually large move relative to average volatility. If the average volatility measured over N days is

$$V_i(N) = \frac{1}{N} \sum_{t=1}^N D_{t-i+1}$$

where D is the maximum of

(a) $|H_t - C_{t-1}|$

(b) $|H_t - L_t|$

(c) $|L_1 - C_{t-1}|$

and H_i is the high on day i

C_i is the close on day i

L_i is the low on day i

Trading rules are given as

Sell if the close drops by more than $K \times V(N)$ from the previous day

Buy if the close rises by more than $K \times V(N)$ from the previous day

The value of K is generally about 3.0.

¹ Richard Bookstaber, *The Complete Investment Book* (Scott, Foresman, Glenview, IL, 1987).

Note that the average volatility should not include the current day t . A comparison of today's volatility using an average containing that value might cause inconsistent signals.

The 1 ODay Moving Average Rule

The most basic application of a moving average system was proposed by Keltner in his 1960 publication, *How to Make Money in Commodities* (The Keltner Statistical Service, Kansas City, 1960). Of three mechanical systems presented by Keltner, his choice of a moving average was based on performance and experience. The system itself is quite simple: a 10day moving average based on the average of the daily high, low, and closing prices, with a band on each side formed from the 10day moving average of the highlow range. A buy signal occurs on penetration of the upper band and a sell signal when the lower band is broken; positions are always reversed.

The 10Day Moving Average Rule is basic, but it does account for the fundamental volatility principle and serves as an example of the actual use of moving averages. Keltner expresses his preference for this particular technique because of its identification of minor rather than medium or

longterm trends, and there are some performance figures that substantiate his conclusion. As an experienced trader, he prefers the speed of the 10day moving average, which follows the market prices with more reasonable risk than slower methods. A side benefit to the selection is that the usual division required by a moving average calculation can be substituted by a simple shift of the decimal place; in an era before the pocket calculator, who knows how much impact that convenience had on Keltner's choice?

Triple Exponential Smoothing

A triple exponential smoothing technique was described by Hutson as another approach to trend following.² Substituting the log of the price for the price itself he applied an exponential smoothing three times using the same smoothing constant. A buy signal was generated when the triplesmoothed series rose for 2 consecutive days; a sell signal followed a 2day decline.

The smoothing constant selected would normally be faster (less than a 20day equivalent, when $2/(n + 1)$ is used to convert the n days to a smoothing constant) for a triple smoothing than for a single smoothed line. It is interesting to see what actually happens when a series is smoothed three times. For example, a triple smoothing of a straight 3day moving average gives the following:

$$P = (P_1, P_2, \dots, P_n)$$

The single moving average at day n is

$$M_n = \frac{(P_{n-2} + P_{n-1} + P_n)}{3}$$

Smoothing the new series M gives

$$\begin{aligned} M'_n &= \frac{(M_{n-2} + M_{n-1} + M_n)}{3} \\ &= \frac{(P_{n-4} + 2P_{n-3} + 3P_{n-2} + 2P_{n-1} + P_n)}{9} \end{aligned}$$

and the third smoothing gives

² Jack K. Hutson, "Good TRIX," *Technical Analysis of Stocks*

$$M_n'' = \frac{(M'_{n-2} + M'_{n-1} + M'_n)}{3}$$

$$= \frac{(P_{n-6} + 3P_{n-5} + 6P_{n-4} + 7P_{n-3} + 6P_{n-2} + 3P_{n-1} + P_n)}{27}$$

The effect of the weighting puts increased importance on the middle values, reducing the significance of both ends. With exponential smoothing as well, the increased emphasis will be placed on the $n - 2$ value, the price which is repeated most often.

The Parabolic Time/Price System

One of the primary complaints about trendfollowing systems is that the builtin lag destroys the trade. In the Parabolic Time/Price System,' Wilder has reduced the tag by increasing the speed of the trend (shortening the days) whenever prices achieve new profitable levels. The philosophy of the Parabolic System is that time is an enemy. Once a position is entered, it must continue to be profitable or it will be liquidated.

The Parabolic Time/Price System is always in the market; whenever a position is closed out, it is also reversed. The point at which this occurs is caned the Stop and Reverse (SAR). When plotted, it is similar to a trendline, although it has a decreasing lag (the distance between the current price and the trendline, or SAR point), as shown in Figure 54.

To calculate the SAR value, fast assume a long or short position. If the market has recently moved lower and is now above the lows of that move, assume a long. Call the lowest point of the previous trade the SAR initial point (SIP), because it will be the starting point for the SAR calculation (SAR, = SIP).

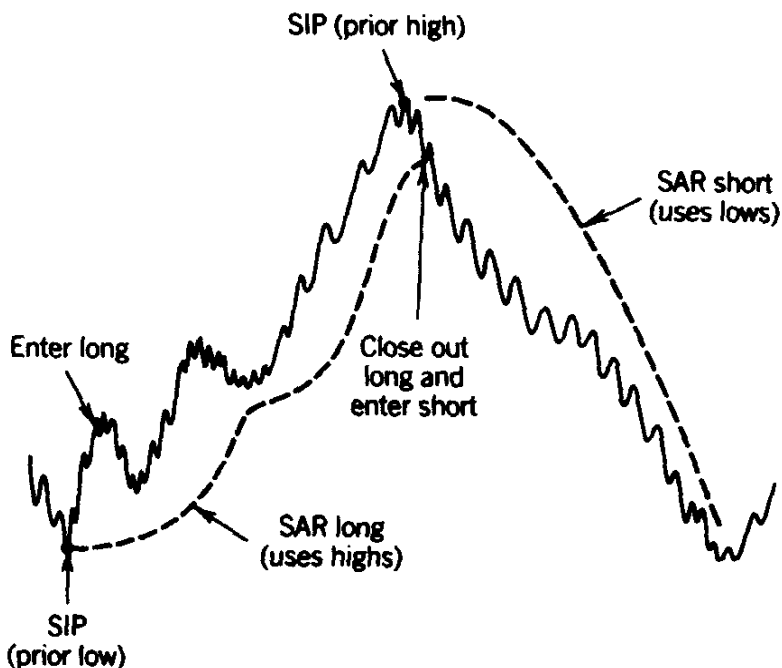
Calculate each following SAR as

$SAR(\text{tomorrow}) = SAR(\text{prior}) + AF \times [High(\text{today}) - SAR(\text{prior})]$

This is an exponential smoothing using the prior high price. It is unique because the smoothing constant AF, called the acceleration factor, changes. AF is set to .02 at the beginning of the trade. Each day that a new extreme occurs (a new high when long, or a new low

3 J. Welles Wilder, Jr., *New Concepts in Technical Trading System* (Trend Research, Greensboro, NC, 1978).

FIGURE 54 Parabolic Time/Price System.



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when short), AF is increased by .02. In moving average days, AF begins at 99 days and increases in speed to a maximum of a 9day moving average, but not in a linear fashion.

In the SAR calculation, High(today) is used when a long position is held, and Low(today) is used when a short is held. An additional rule also prevents premature reversal by not allowing the SAR to enter the price range of the most recent 2 days.

If long, the SAR may never be greater than the low of today or the prior day. if it is greater than this low, set the SAR to that low value. A reversal will occur on a new intraday low that penetrates the SAR.

If short, the SAR is calculated in the same way based on the highs.

Wilder's Parabolic Time/Price System was a new and interesting ideavarying the exponential smoothing constant. This could also be accomplished by varying the moving average days, but not as effectively. The constant increment of .02 and the limitations of the range, .02 to .20, are likely to be shortcomings. Traders might want to relate the changing speed to more basic price phenomena such as volatility or momentum. For those readers interested in the further development of this method, the Parabolic Time/Price System is combined with Directional Movement (described in Chapter 23) to form the Directional Parabolic System discussed in Chapter 6.

The MasterTrading Formula

Another method of variable speed is Mart's The Master Trading Formula.' it uses an exponential smoothing formula in which the smoothing

constant and band are calculated daily, based on market volatility. Mart averages the extended daily range (using the maximum of yesterday's close and today's high and low) and the net price movement over the same interval to define a correlated volatility factor. This value is then used to look up a smoothing constant in a modified logscale table, in which an 8% smoothing (24day equivalent) is used for the lowest volatility and a 33% smoothing (2day equivalent) for the greatest volatility, with the median value at 14% (13day equivalent).

A band is also placed around the trendline, based on an inverse relationship to the correlated volatility factor. The band is widest when there is low volatility and the smoothing constant produces a slow trend; it is narrowest in fast, highly volatile markets.

Rules for trading Mart's Master Formula are centered around the basic band trading rules. The system is always in the market, taking long positions when the upper band is broken and short positions when the lower band is crossed.

Raschke's First Cross

Although we usually trade a trend from the beginning to end based on some smoothing method, Linda Bradford Raschke has shown that a selected piece of the trend move can be a very reliable trade. Her First Cross system enters a trend trade on the first pullback after an initial trend signal based on a faster momentum indicator. She did not offer any exit rules, but there are some that can be suggested. To create this program we need

slowMA Slowmoving average, part of oscillator calculation

fastMA Fastmoving average, part of oscillator calculation

osc Moving average oscillator, fastMA slowMA

trend Moving average of osc

The oscillator is the difference between the fast and slowmoving averages

osc = fastMA - slowMA

'Donald S. Mart, The Master Trading Formula Winsor Books, Brightwaters, NY 1981).

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To generate a buy or sell entry signal, use the following steps (comments on the right):

B1. osc[1]> trend and osc <= trend osc crosses

B2. low > low[1] low of bar

B3. buy

S1. osc[1] < trend and osc >= trend osc crosses

S2. high < high[1] high of the

S3. sell

A likely exit rule for the First Cross system should maintain the shortterm nature of the selection. You might simply consider the entry on the first pullback as better entry timing for a longerterm trend. Or, you

might want to trade only the short period isolated by the first pullback until this initial impulse is exhausted. If you chose the second method, you might try the following exit condition:

Exit for a long position

X1. `close[1] > close[2]`

close of bar turns up (

X2. `close < close[1]`

after going up, the clo

X3. `exit long`

Raschke's idea is an excellent example of selectivity. First, you recognize that the beginning of a trend is different from other times. As traders recognize a change of direction there is an increasingly strong move. Because most systems lag the market, they are often too late or miss the first part of the turn, which could create large profits. As an alternative, this technique waits for the first move to be exhausted, then enters in anticipation of another fast surge as the new trend reasserts itself. Once these early moves are over, the general trend move may not be as easy to work with, and you may find Yourself trying to enter as the trend comes to an end.

COMPARISON OF MAJOR TREND SYSTEMS

A section on trends cannot be complete without looking at the comparative performance of the six most popular approaches:

1. Simple moving average
2. Exponential smoothing
3. Linear regression slope
4. Nday breakout
5. Swing breakout
6. Pointandfigure

Trading Rules

To see the characteristics of each system, the trading rules will be as simple as possible. All six systems are always in the market. That is, once they enter a long or short position, they always reverse on a new signal, going from long to short, or short to long. There are no stoplosses or other risk control rules; therefore, each system has its own, natural risk profile. A \$100 roundturn charge was applied to each trade to cover commissions and slippage. Table 52 summarizes the type of system, calculation method, and trading rules.

Varying the Speed of the Trend

Each system must be tested with a wide range of fast and slow trends. For systems 1 through 4, the period, or number of days, *n*, determines the trend speed. For the swing

TABLE 5-2 Summary of Six Major Trending Systems

<i>System Type</i>	<i>Formulas</i>
1. Simple moving average MA is the average of previous <i>n</i> -day closing prices.	$MA = @Sum(close, n) / n$ $MA = @Average(close, n)$ $MAchange = MA - MA[1]$
2. Exponential smoothing EXP is a weighting of the recent closing price by a percentage, <i>s</i> (called the <i>smoothing constant</i>).	$EXP = EXP[1] + s * (close - EXP[1])$ $EXPchange = EXP - EXP[1]$
3. Linear regression slope LRS is the slope (angle) of a straight line found using a least-squares regression.	$LRS = \frac{n * \sum(x * c) - \sum(x) * \sum(c)}{n * \sum(x * x) - \sum(x) * \sum(x)}$ where <i>c</i> is the close, and <i>x</i> are the integers, 1, 2, 3, ..., <i>n</i>, representing the time intervals
4. N-day breakout Signals occur when the current price reaches a new high or low (a "breakout") for both intraday and end of day, based on the previous <i>n</i> -days.	$nhigh = @high - est(high[1], n - 1)$ $nlow = @lowest(low[1], n - 1)$
5. Swing breakout Signals occur when the current high or low price exceeds the previous swing high or low price. A swing is a price move that begins with a reversal of a minimum percentage value.	<i>swhigh</i> is the highest price that occurs before a price decline of <i>p</i>*<i>swhigh</i>, where <i>p</i> is a percent. <i>swlow</i> is the lowest price that occurs before a rally of <i>p</i>*<i>swlow</i>, where <i>p</i> is a percent.
6. Point-and-figure Signals occur when the current high or low price exceeds the previous high or low, which is formed by filling boxes of a preset point size.	Same rules as Swing Breakout, except that new highs and lows are recorded only if they exceed preset box size. A reversal is recorded if a minimum of 3 boxes can be filled, not including the current box

TABLE 5.3 Eurodollar Results for Six Systems (1985–1994)

System	Rules																	
ED	1. Moving average (MA)	1. Tradestation closed-out trades only																
	2. Exponential smoothing (EXP)	2. First 200 days used for initialization																
	3. Linear regression slope (LRS)	3. Commissions and slippage at \$100 per trade																
	4. Swing breakout (SWG)	4. Test data from 1/1/84 to 3/31/94 unless indicated																
	5. Point-and-figure (P&F)	5. TYPE = 0, standard; 1, 3-month rule; 2, bonds																
	6. N-day breakout (NDBO)																	
		1. No memory of past period. 2. Whips limit minimum number of trades (need filter). 3. Monthly small losses.																
		1. Some memory of past prices. 2. Whips limit minimum number of trades (need filter). 3. Monthly small losses.																
		1. Projects direction as mean (economics). 2. Price penetration does not cause whips. 3. Losses can be larger than MA or EXP.																
		3. LINEAR REGRESSION SLOPE																
		2. EXPONENTIAL SMOOTHING																
		1. MOVING AVERAGE																
	Days	#Prf	#Trds	Rel	Rel%	S/D	Days	#Prf	#Trds	Rel	Rel%	S/D	Days	#Prf	#Trds	Rel	Rel%	S/D
	4	131	433	30.3	-79	-0.18	4	136	515	26.4	-88	-0.17	4	171	537	30.7	-90	-0.16
	8	88	274	32.1	51	0.19	8	90	316	28.5	-17	-0.06	8	91	259	35.1	-4	-0.02
	16	51	182	28.0	134	0.34	16	51	214	23.8	44	0.21	16	41	127	32.3	27	0.21
	32	37	111	33.3	566	5.10	32	32	117	27.4	365	3.12	32	21	55	38.2	218	4.33
	50	31	95	32.6	208	2.19	50	25	87	28.7	91	1.05	50	16	39	41.0	216	5.54
	75	17	65	26.2	267	4.11	75	19	73	26.0	135	1.85	75	13	29	44.8	156	5.38
	100	15	43	34.9	281	6.53	100	22	51	43.1	257	5.04	100	5	15	33.3	141	9.40
	150	8	21	38.1	468	22.29	150	12	27	44.4	473	17.48	150	8	11	72.7	279	35.36
	200	9	44	30.5	5	0.11	200	9	43	21.4	5	0.13	200	1	4	14.3	187	17.03

TABLE 5.3 (Continued)

1. Signals on natural level without memory.										1. Signals on natural level plus filter.									
2. Whips mostly on expanding market swings.										2. Fewer whips unless expanding market.									
3. Risk increases with range.										3. Risk increases with swing size.									
4. N-DAY BREAKOUT										5. SWING BREAKOUT (type=1)									
Days	#Prf	#Trds	Rel	Rad%	%/Tr	%	#Prf	#Trds	Rel	Rad%	%/Tr	Box	#Prf	#Trds	Rel	Rad%	%/Tr	6. POINT-AND-FIGURE	
ED	4	108	283	38.2	84	0.30	134	381	35.2	-67	-0.18	0.004	126	406	31.0	-78	-0.19		
	8	58	143	40.6	240	1.68	132	371	35.6	-47	-0.13	0.008	124	368	33.7	-60	-0.16		
	16	29	77	37.7	188	2.44	105	279	37.6	36	0.13	0.016	96	275	34.9	-15	-0.05		
	32	17	37	45.9	459	12.41	80	217	36.9	157	0.72	0.025	70	180	38.9	84	0.47		
	50	12	27	44.4	347	12.85	57	137	41.6	69	0.50	0.033	59	147	40.1	133	0.90		
	75	8	15	53.3	423	28.20	34	83	41.0	94	1.13	0.050	34	83	41.0	115	1.39		
	100	6	13	46.2	215	16.54	18	51	35.3	404	7.92	0.067	23	62	37.1	73	1.18		
	150	4	7	57.1	431	61.57	14	33	42.4	375	11.36	0.083	17	40	42.5	337	8.43		
	200	1	6	16.7	106	17.67	10	17	58.8	458	26.94	0.100	11	28	39.3	307	10.96		
							7	15	46.7	123	8.20	0.133	7	16	43.8	264	16.50		
							5.00				5.7	0.167	2	10	20.0	-4	-0.40		
Avg	70.6	27.0	67.6	42.2	277.0		2.1	59.1	158.4	41.1	160.2		0.062	51.7	146.8	36.6	105.1		
SD				10.9	134.4					6.9	178.4					6.4	121.7		
A-sd				31.3	142.6					34.2	-18.2					30.2	-16.6		

EXPLANATION OF COLUMNS:

Column 1: days, number of days in the calculation period; %: percentage of price for minimum swing criteria; box size in points; reversal criteria is 3 x box. Column 2: #Prf, number of profitable trades. Column 3: #Trds, total number of trades. Column 4: Rel, reliability the percentage of profitable trades. Column 5: Rad%, risk-adjusted 10-year returns. Rad% = PJMaxDrawdown/Column 6: %/Tr, profit per trade in %.

breakout, a percentage swing makes it more or less sensitive to price movements. Pointandfigure uses a constant box size, which is then multiplied by 3 to get the reversal size.

Tests shown in Table 53 for the Eurodollar confirm a broad range of trading from very shortterm to very longterm. The number of trades varies from over 500 in 10 years (about 2,500 days) to 6 trades in 10 years. Some showed a fairly high minimum number of trades for the longest periods.

Different Trend Philosophies

The moving average, exponential, and linear regression are timeseries processes; that is, each day is a small part of the total calculation. This can make it very difficult for a single large price jump to cause a change of signal. For very fast trends, each price will have more importance than for slower trends.

The Nday breakout, swing breakout, and pointandfigure systems all depend on a price breakout. A signal occurs when the market makes a new high or low. Therefore, a single big move often causes a new signal. Breakout systems can be considered event driven, while a moving average system requires a trend to evolve.

Different Risk Profiles

Each of the six systems fall into particular categories of risk profiles.

Moving Averages and Exponential Smoothing

Both the moving average and exponential smoothing return a weighted average. The simple moving average uses equal weighting, and the exponential gives more importance to the most recent value, according to the smoothing constant, s .

Both systems are considered conservationofcapital methods because they keep losses small. When current price levels are trading near the nday average, it takes very little to change the trend from up to down and back to up. Although this is annoying to traders, it is part of the conservationofcapital benefit. Table 53 shows that the minimum number of trades were 42 to 44 for these systems, far greater than the other four strategies. The whipsaws seem to increase as the trends become very slow, which is the reason for using a filter, or band, in most trend systems. In Table 53 the number of trades doubled when the trend stowed from 150 to 200 days.

Breakout Systems

The swing breakout, pointandfigure, and Nday breakout systems can all be grouped as highrisk strategies. Once a buy signal has occurred because of new high prices, the trade is reversed only when new low prices occur. The initial risk is

breakout risk = highest high - lowest low

for the Nday period. The rate at which risk declines is different for each of the systems. The swing breakout and point and figure systems reduce risk each time a new swing low occurs only if that low is higher than the previous swing low (see Figure 55). The Nday breakout reduces risk if the oldest days, which are dropped off, were also the lowest prices. Otherwise, its risk is the same as the other breakout systems.

Linear Regression Risk

The linear regression method, which creates a straightline forecast, is very different from other trending systems. It does not change direction when prices move up or down through the trendline (as in the smoothing systems). It is possible that a very large, but fast price drop, which recovers quickly, will not cause a long position signal to reverse.

highs become the point at which signals reverse. This pattern is the same for point and figure.

reversal 1



reversal 2



sell
reversal 3



(This

graph made up from book with Draw)

Least squares puts the greatest importance on those prices closest to the straightline estimate. It is very sluggish to change direction when a larger number of days is used. Because of this pattern, it can have a mixture of large and small losses.

Frequency of Trades

You might notice that the number of trades varies considerably across systems. This reflects their risk. The longer you hold a trade, the greater the risk exposure. The two smoothing systems (moving average and exponential smoothing) cut losses short; therefore, they show the largest number of trades for a slow trend.

Breakout systems can trade very little if they enter on a new high after a volatile market period. A long position can be held for months waiting for the swing low to move up. An expanding range, one that makes a new high, followed by a new low and another new high, can be devastating.

Expectations

We form expectations so that we can recognize when test results are wrong. It is the same as an engineer estimating the length of a bridge

before a computer program produces the final numbers. An accidental shift of a decimal point may give you plans for a 10foot bridge over a 100foot river.

Similar Systems Give Similar Results

We expect the first two and last two systems to be very similar. In each case the rules are nearly the same. We expect the Nday breakout to have the highest risk because volatility increases over time. The nday high and low should create a much larger range than the most recent swing high and low. Of course, we expect slower systems to be more profitable than faster ones, because longer periods often reflect fundamental price movements.

Robust Testing

To get the most value from these tests (an approach covered in detail in Chapter 21), there needs to be as much consistency as possible between tests. The following standards are set:

- 1. Test periods. All markets and all tests covered the same 10year period, ending March 31, 1994 (except the OEX, which began in 1986 and totaled 9 years).
- 2. Range of trend speeds. Those systems that used days were tested from 4 to 200. Systems 5 and 6, swing breakout and pointandfigure, used values that produced a similar number of trades.

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- 3. Adjusted rate of return. Returns were specified as the 10year return divided by the maximum intraday drawdown.
- 4. Test averages. Below each test group are the averages of all tests, the standard deviation of the total returns, and the average minus one standard deviation. The best result is the system with the highest average return and the smallest standard deviation.

Which System Is Best?

Table 54 gives only the average returns by system and market. it then averages those results down and to the right, giving the average of averages. Results show that Eurodollars were profitable for all systems and that the Nday breakout had the best returns for all markets. In trying to understand the results, it is useful to remove those tests that resulted in very few trades or too many trades to be practical. Table 55 presents the same results for all results with the number of trades from 24 through 260 over the 10year period (from 2.5 per year to 1 every 2 weeks). The table shows that the simple moving average was much better and the Nday breakout much worse. Total results were better, showing that the fast trends were big losers. This is particularly true of the smoothing methods.

A Different View of Results

The average results give a reasonable picture of performance, but it is clear that each type of system has a different distribution of trades. For example, doubling the swing percent

TABLE 5-4 Average Returns

	MA	EXP	LRS	SWG	P&F	NDAY	Avg
ED	211	140	119	160	105	277	169
US	108	72	17	-24	-6	123	48
DM	133	95	141	16	81	106	95
SP	-57	-44	-66	-24	-27	-49	-44
OEX	-35	-23	-29	-12	-17	-7	-21
CL	135	112	47	-18	-30	152	66
SY	16	-14	108	39	47	78	45
Avg	73	48	48	20	22	97	51

The average of all tests gives a better picture of the robustness of the systems and the trendiness of the markets. Each value is a 10-year risk-adjusted return.

TABLE 5-5 Average Returns for Tests with 24–260 Trades

	MA	EXP	LRS	SWG	P&F	NDAY	Avg
ED	276	196	127	220	175	309	217
US	153	111	26	13	27	28	59
DM	192	139	285	-1	123	57	132
SP	-44	-31	-60	-18	-48	-80	-47
OEX	-11	-2	-11	18	1	-46	-8
CL	196	165	153	13	-16	215	121
SY	47	22	14	53	93	-69	27
Avg	116	86	76	43	51	59	72

By limiting the test periods to a more popular range, we see that the simple moving average is best, although the markets perform relatively the same way.

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age does not reduce trades as quickly as doubling the days in the Nday breakout. This causes the average results of the two systems to be biased differently toward faster or slower trends. This is corrected by comparing the systems when they have the same number of trades.

Aligning Test Results Graphically

Figure 56 shows the Eurodollar results when we attempt to align each of the six systems by their test periods. The patterns are similar, but somewhat out of phase. This is especially true for the breakout systems. By displaying performance of all systems by total trades, shown in Figure 57, we see a steady decline from left to right. As the number of trades increases, profits disappear.

We can conclude that trending systems, in general, are a robust trading vehicle for Eurodollars, but only if we apply a longer time horizon. The patterns clearly show that increasing trades result in overall losses. This should be a very comforting conclusion for systems traders.

Programming the Six Systems

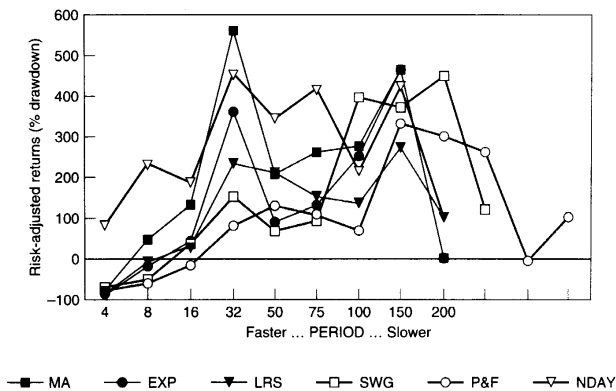
Omega Easy Language Code

A general systems approach to programming TradeStation's Easy Language has been taken in this example. The strategies are written as User Functions rather than systems. This adds flexibility and allows us to use the same programs at another time. A User Function is a small program or subprogram that can be referenced (called) from other programs. This shared program saves you from repeating the rules and calculations for each new program.

FIGURE 56 Eurodollar results by test period. The rising pattern of profits from left to right is not clear because of the difficulty in aligning the test period, in days, with the swing size, in percent.

Eurodollar: riskadjusted returns

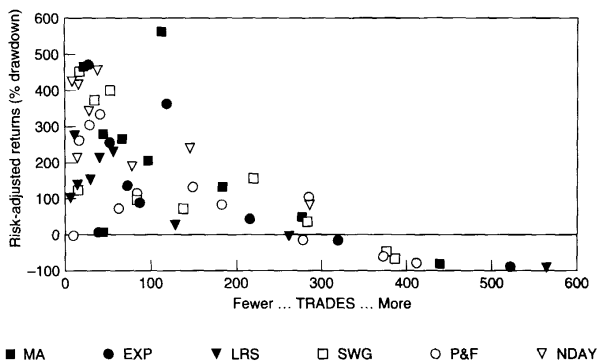
All systems by test period



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FIGURE 57 Eurodollar results by total trades. Plotting all systems by total trades (the bottom scale) shows a clear drop in performance as trading becomes more frequent.

Eurodollar: riskadjusted returns
All systems by total trades



The following User Functions perform the unique calculations for each of the six strategies, and return the value

signal = 0, no position

= 1, buy or hold long position

= -1, sell or hold short position

Note that the final statement of the User Function sets the User Function name equal to the value of the signal. Each program also references a variable type, which indicates that the market being processed is, or is not, an interest rate. type = 0, default

= 1, 3-month interest rate (e.g., Eurodollars, Matif

= 2, long-term interest rate (e.g., U.S. T-bonds, T-n

System

A system has buy and sell orders, equity calculations, and other statistics. Parameter values can be set from the appropriate menu. Our systems will reference a User Function to find the signal for each strategy. Because each of the systems would be identical, except for the one line that calls the user function, only one system is shown.

Indicator

An indicator is a program that displays the value of key points or calculations on a chart. An indicator can position the high and low points of a swing (Kswing) or show a separate graph on a split page (KLRS).

{KMA : Moving Average User Function
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```

{period = length of moving average trend
 filter = whole % trend change to give
 lag = 0 to enter on close, n to enter
}
input: period(numericsimple), filter(nu
vars: ma(0), change(0), signal(0);

signal = signal[1];
{moving average for testing anticipation
ma = @Average(close,period);
change = (ma - ma[1])*100/close[1];
{long signal}
if lag >= 0 and change[lag]>filter then
{short signal}
if lag >= 0 and change[lag]<-filter then
KMA = signal;
}

{KEXP exponential User Function
 Copyright 1994-1998, P J Kaufman. All
}
{period = length of exponential trend
 filter = whole percent trend change to
 lag = 0 to enter on close, n to enter
}
input: period(numericsimple), filter(nu
vars: exp(0), change(0), signal(0);

signal = signal[1];
{Exponential smoothing for testing anti
Exp = @SmoothedAverage(close,period);
change = (Exp - Exp[1])*100/close[1];
{long signal}
if lag >= 0 and change[lag]>filter then
{short signal}
if lag >= 0 and change[lag]<-filter then
KEXP = signal;
}

{KLRS : Linear Regression Slope User Fun
 Copyright 1994-1998, P J Kaufman. All
 Method of least squares to calculate s
 Inputs: period(numericsimple);
 vars: sumx(0), sumx2(0), sumy(0), sum
 slope(0), yint(0);

{Time = x, the independent variable, e.
 Close = y, the dependent variable}

{standard sum of integer series}
sumx = period*(period+1) / 2;
sumx2 = period*(period+1)*(2*period+1
sumy = @summation(close,period);
sumxy = 0;
n = period;
for k = 0 to period-1 begin
sumxy = sumxy + n*close[k];
n = n - 1;
end;
top = period*sumxy - sumx*sumy;
bot = period*sumx2 - sumx*sumx;
if bot<>0 then slope = top / bot;
{yint = (sumy - slope*sumx) / period;}
KLRS = slope;

```

```

(KLRSIGNAL : Linear Regression Slope signal User Function
 Copyright 1994-1998, P J Kaufman. All rights reserved.)

{period = length of exponential trend
 filter = whole % trend change to give signal
}
input: period(numeric), filter(numeric), lag(numeric);
vars: slope(0), signal(0);

(Call linear regression slope User Function)
slope = KLRS(close,period);
signal = signal[1];
{long signal : slope is up by more than filter}
if lag >= 0 and slope[lag]>filter then signal = 1;
{short signal : slope is down by more than filter}
if lag >= 0 and slope[lag]<-filter then signal = -1;
KLRSIGNAL = signal;
}

(KNDB : N-Day Breakout User Function
 Copyright 1994-1998, P J Kaufman. All rights reserved.)

INPUT for N-day Breakout System signal rules:
BUY when high is above N-day high and close > prior close
SELL when low is below N-day low and close < prior close:

input: period(numeric);
vars: nhigh(0), nlow(0), signal(0);

nhigh = highest(high[1],period - 1);
nlow = lowest(low[1],period - 1);
{Buy and sell signals}
signal = signal[1];
if high > nhigh and close > close[1] then signal = 1;
if low < nlow and close < close[1] then signal = -1;
KNDB = signal;
}

(KSWG : User Function to determine swing direction and new swing highs and lows
 Copyright 1994-1998, P J Kaufman. All rights reserved.)

INPUT for KSWG
swing in whole percent
direction & breakout:
+1 up, +2 up breakout
0 none
-1 dn, -2 dnbreakout
type : 0= normal, 1= 3 month rate, 2= bond
signal rules:
buy when upswing is above prior upswing
sell when downswing is below prior downswing:

input: swing(numeric), type(numeric);
vars: minswing(0), last(0), curhigh(0), curlow(0), swingdir(0), swing(0),
swingdir(0), signal(0);

minswing = swing*close/100;
if type=1 then minswing = swing*(100 - close) / 100;
if type=2 then minswing = swing*(8./close)
{SWINGS: Initialize most recent high and low:
if (currentbar = 1)then begin
curhigh = close; {current high}
curlow = close; {current low}
end;
{Search for a new high}
if last<>1 then begin

```

END

lit

```

    if high > curhigh then curhigh = high;      {new current high}
    if low < curhigh - minswing then begin
        last = 1;      {last high fixed}
        swhigh = curhigh; {new verified high}
        curlow = low;   {initialize new lows}
    end;
end
{Search for a new low}
else begin
    if last <> -1 then begin
        if low < curlow then curlow = low;
        if high > curlow + minswing then begin
            last = -1;
            swlow = curlow;
            curhigh = high; {initialize current high}
        end;
    end;
end;
{Buy and sell signals}
signal = signal[1];
swingdir = 0;
if last = 1 then begin
    swingdir = -1;
    if curlow < swlow then signal = -1;
end;
if last = -1 then begin
    swingdir = 1;
    if curhigh > swhigh then signal = 1;
end;
KSWG = signal;

```

```

{KPF : Point & Figure User Function
Copyright 1994-1998, P J Kaufman. All rights reserved.}
INPUT for KMA_PF_System, swing in whole percent
direction & breakout:
    +1 up, +2 up breakout
    0 none
    -1 dn, -2 dnbreakout
type : 0= normal, 1= 3 month rate, 2= bond
signal rules:
    buy when upswing is above prior upswing
    sell when downswing is below prior
        downswing}

input: box(numeric), revboxes(numeric);
vars: minswing(0), last(0), curhigh(0), curlow(0), swhigh(0), swlow(0),
swingdir(0), signal(0);

{For percentage calculations:
minswing = swing*close/100;
if type=1 then minswing = swing*(100-close) / 100;
if type=2 then minswing = swing*(8./close)}
minswing = box*revboxes;
{SWINGS: Initialize most recent high and low}
if currentbar = 1 then begin
    curhigh = close;      {current high}
    curlow = close;       {current low}
end;
{Search for a new high}
if last<> 1 then begin
    if high > curhigh+boxsize then curhigh = high; {new current high}

```

```

        if low < curhigh - minswing then begin
            last = 1;           {last high fixed}
            swhigh = curhigh;   {new verified high}
            curlow = low;       {initialize new lows}
        end;
    end
{Search for a new low}
else begin
    if last <> -1 then begin
        if low < curlow-boxsize then curlow=low;
        if high > curlow+minswing then begin
            last = -1;
            swlow = curlow;
            curhigh = high; {initialize current high}
        end;
    end;
end;
{Buy and sell signals}
signal = signal[1];
swingdir = 0;
if last = 1 then begin
    swingdir = -1;
    if curlow < swlow then signal = -1;
end;
if last = -1 then begin
    swingdir = 1;
    if curhigh > swhigh then signal = 1;
end;
KPF = signal;

```

SYSTEM

The following system can be used for any of the six methods by changing the braces (comment notation)

```

{System Signals.
 Copyright 1994-1998, P J Kaufman. All rights reserved.}

{type = 0, default,
 1, 3-month rate
 2, long-term rates
period = length of calculation
swing = swing filter in whole percent (i.e., 1.5 = 1½ percent)
filter = whole % trend change to give signal
}
input: type(0), period(0), swing(0), box(0), revboxes(0), filter(0), lag(0);
vars: signal(0);

{Call User Function}
signal = KMA(period,filter,lag);
{signal = KLRSignal(period);}
{signal = KNDB(period);}
{signal = KSWG(type);}
signal = KPF(box, revboxes);
if signal = 1 then buy at close;
if signal = -1 then sell at close;

```

INDICATOR

The KMA Swing Indicator plots the high and low swing points above and below the corresponding prices. Select the *scale-by-price* feature.

```

{KMA SWING: Finds most recent swing
 highs and lows.
 Copyright 1994-1998, P J Kaufman. All rights reserved.

 Inputs for KMA SWING:
   swing = price swing in %
   type  = 0, normal; 1, 3-month rate; 2, bond rate
   index = 0, treat as price;
           1, create index series
}

input: swing(1.5), type(0), index(1);
vars:  pcswing(0), last(0), curhigh(0), curlow(0),
       swhigh(0), swlow(0), highbar(0), lowbar(0),
       chighbar(0), clowbar(0), lowp(0), highp(0),
       aclose(0), ahigh(0), alow(0), xclose(0),
       xhigh(0), xlow(0), factor(1);

pcswing = swing/100.;
aclose = close;
ahigh = high;
alow = low;
factor = 1;
if type <> 0 then factor = -1;
{Adjust prices if interest rates}
if type = 1 then begin
  aclose = 100. - close;
  ahigh = 100. - low;
  alow = 100. - high;
end;
if type = 2 then begin;
  aclose = 800./close;
  ahigh = 800./close;
  alow = 800./close;
end;
{Initialize most recent high and low}
if currentbar = 1 then begin
  if index = 0 then begin
    xclose = aclose;
    xhigh = ahigh;
    xlow = alow;
  end
  else begin
    xclose = 100.;
    xhigh = ahigh*100 / aclose;
    xlow = alow*100 / aclose;
  end;
  curhigh = xclose;      {current high}
  curlow = xclose;      {current low}
end
else begin
  if index = 0 then begin
    xclose = aclose;
    xhigh = ahigh;
    xlow = alow;
  end
  else begin
    xclose = xclose[1] + (aclose - aclose[1])*100 / aclose[1];
    xhigh = xclose[1] + (ahigh - aclose[1])*100 / aclose[1];
    xlow = xclose[1] + (alow - aclose[1])*100 / aclose[1];
  end;
end;

```



```

        end;
        {Search for a new high - favor reversals}
        if last<>1 then begin
            {Reverse from high if minimum % swing}
            if xlow < curhigh - curhigh*pcswing then begin
                last = 1;           {last high fixed}
                swhigh = curhigh;   {new verified high}
                highbar = chighbar;
                curlow = xlow;       {initialize new lows}
                lowp = low;
                clowbar = currentbar;
                plot1[currentbar - highbar](high[currentbar - highbar]
                    + factor*highp*pcswing/4,"swinghigh");
            end
        else begin
            if xhigh > curhigh then begin
                curhigh = xhigh;    {new current high}
                chighbar = currentbar;
            end;
        end;
    end;
end;
{Search for a new low - favor reversal}
if last <> -1 then begin
    {Reversal from low if minimum % swing}
    if xhigh > curlow + curlow*pcswing then begin
        last = -1;
        slow = curlow;
        lowbar = clowbar;
        curhigh = xhigh;          {initialize current high}
        highp = high;
        chighbar = currentbar;
        plot2[currentbar - lowbar](low[currentbar - lowbar]-
            factor*lowp*pcswing/4,"swinglow");
    end
else begin
    if xlow < curlow then begin
        curlow = xlow;
        clowbar = currentbar;
    end;
end;
end;
end;

```

Spreadsheet Code

In the following QUATTRO code, the GENERAL DESCRIPTION precedes a row or column that is fixed A6 Date (YYMMDD) (i.e., it does not get copied down).B6 High price C6 Low price Moving average, exponential, and Nday D6 Closing price breakout share the same page, as do the C3 Test period, swing %, or box size swing breakout and pointandfigure system C 5 Pointandfigure number of reversal boxes The price data is not repeated to save space. AN data starts in row 7

```

MOVING AVERAGE
C3      period (e.g., 5 day)
E3      filter (e.g.,.10 for OEX data)

```

```

Repeated process (copy down)
E11 MA @Avg(D7..D11)
F11 Dir @IF(E11 - E10>$E$3,1,@IF(E11 - E10<-$E$3,-1,F10))
G11 Entry @IF(F11=1#AND#F10<>-1,"Sell",@IF(F11=1#AND#F10<>1,"Buy",""))

```

EXPONENTIAL SMOOTHING

```

C3 period (e.g., 5 day)
E3 filter (e.g.,.10 for OEX data)
G3 smoothing constant 1 / (C3+1)
Initialize
E6 EXP +D6
Repeated process (copy down)
E7 EXP +E6+$G$3*(D7 - E6)
F7 Dir @IF(E7 - E6>$E$3,1,@IF(E7 - E6<-$E$3,-1,F6))
G7 Entry @IF(F7=-1#AND#F6<>-1,"Sell",@IF(F7=1#AND#F6<>-1,"Buy",""))

```

N-DAY BREAKOUT

```

Repeated process (copy down). There are no constants and no initialization
E11 Nhigh @Max(B6..B10)
F11 Nlow @Min(C6..C10)
G11 Dir @IF(B11>E11#AND#D11>D10,1,@IF(C11<F11#AND#D11<D10,-1,G10))
H11 Entry @IF(G11=-1#AND#G10<>-1,"Sell",@IF(G11=1#AND#G10<>1,"Buy",""))

```

SWING BREAKOUT

```

C3 Minimum swing percentage
E6 CurH +B6
F6 Curl +C6
G6 H/L @IF(D6>(E6+F6)/2,-1,1)
E7 CurH @IF($G6=-1#AND#B7>E6,B7,@IF($G6=1,B7,E6))
F7 Curl @IF($G6=1#AND#C7<F6,C7,@IF($G6=-1,C7,F6))
G7 H/L @IF($G6=-1,@IF(C7<E7 - $C$3*D7,1,$G6),@IF(B7>F7+$C$3*D7,-1,$G6))
H7 SwH @IF($G7=1#AND#G6=-1,E7,H6)
I7 SwL @IF($G7=-1#AND#G6=-1,F7,I6)
J7 Entry @IF($G7=-1#AND#B7>H7#AND#D7>D6,"Buy",
@IF($G7=1#AND#C7<I7#AND#D7<D6,"Sell",""))

```

NOTE: The point-and-figure spreadsheet code varies slightly from the TradeStation code. It is a more accurate representation of the exact point-and-figure charting method (favoring reversals when possible).

POINT AND FIGURE

```

C3 Point and figure box size
C5 Number of reversal boxes
E6 CurH @INT(B6/$C$3)
F6 Curl @INT((C6+$C$3)/$C$3)
G6 Dir @IF(D6>(E6+F6)/2,1,-1)
E7 CurH @IF($G6=1,@IF(@INT(B7/$C$3)>E6,@INT(B7/$C$3),E6),@INT(B7/$C$3))
F7 Curl @IF($G6=-1,@IF(@INT((C7+$C$3)/$C$3)<F6,@INT((C7+$C$3)/$C$3)),
F6,@INT((C7+$C$3)/$C$3))
G7 Dir @IF(G6=-1#AND#@INT(B7/$C$3)>F7+$D$3-1,1,@IF(G6=1#AND#
@INT((C7+$C$3)/$C$3)<E7 - ($D$3-1),-1,G6))
H7 LastH @IF(G7=-1#AND#G6=1,E7,H6)
I7 LastL @IF(G7=1#AND#G6=-1,F7,I6)
J7 Entry @IF(G7=-1#AND#@INT((C7 - $C$3)/$C$3)<I7,"Sell",
@IF(G7=1#AND#@INT(B7/$C$3)>H7,"Buy",""))

```

LINEAR REGRESSION SLOPE

```

C3 period (e.g.,5)
E3 filter (e.g.,0)
Initialize

```

```

E6      TimeX 1
G6      X^2    E6*E6 (copy down)
J6      XY     E6*D6 (copy down)

Normal processing (copy down all cells)
E7      TimeX +E6+1
F10     SumX   @Sum(E6..E10)
G10     X^2    +E10*E10
H10     SumX^2 @Sum(G6..G10)
I10     SumY   @Sum(D6..D10)
J10     XY     +E10*D10
K10     SumXY  @Sum(J6..J10)
L10     Slope  (($C$3*K10 - F10*I10) / (($C$3*H10 - F10*F10)
M10     Dir    @IF(L10>$E$3#AND#L9<$E$3,1,@IF(L10<-$E$3#AND#L9> - $E$3, - 1,M10))
N10     Entry  @IF(M10=-1#AND#M9<>-1,"Sell",@IF(M10=1#AND#M9<>1,"Buy",""))

```

To verify that the correct code was entered into the spreadsheet, Figure 58 shows a sample of the opening lines of the spreadsheet using sample data. The columns E, F, G, and H have been repeated for each of the moving average, exponential smoothing, and Nday breakout systems. In Figure 59, this approach has been taken for the swing breakout and pointandfigure systems using the same data.

TECHNIQUES USING TWO TRENDLINES

This section is restricted to applications of trendlines; however, do not assume that trendlines constitute the only timing methods. Any secondary system that analyzes a shorter time period than the primary system can be considered as a timing device. Typically a 3day moving average could act as a timing technique for a 10day average; however, the delays of 1, 2, 3, or more days, discussed earlier, are also for timing. A 5day delay would not be a sensible choice to be used with a 3day moving average, because the two periods would be incompatible. Plotting of lag and lead moving average values is another possible timing method. In this section, the use of more than one moving average will be examined (any type of trend approach would apply) to create a system.

In using two averages, the slower one, requiring a longer calculation period, will determine the longterm trend. The faster average will be used for timing. The longterm moving average generates a signal compatible with the longterm trend, regardless of recent patterns. A trader would be more comfortable knowing that there is a recent shortterm surge of prices in the direction of the new position at the moment of entry To implement this idea, select two moving averages, one noticeably faster than the other, and apply either of the two following rules:

1. Buy when the faster moving average crosses the slower moving average going up. Sell when the faster moving average crosses the slower moving average going down.
2. Buy when the current price crosses above both moving averages, and close out long positions when prices cross below either moving average. Sell when the current price crosses below both moving averages, and close out short positions when prices cross above either moving average (Figure 510).

The first set of rules results in constant trading, going from long to short and back again as the longterm trend is violated by the faster trend. The second set of rules allows for a neutral position when the current position is closed out and the longterm trend is not penetrated. One

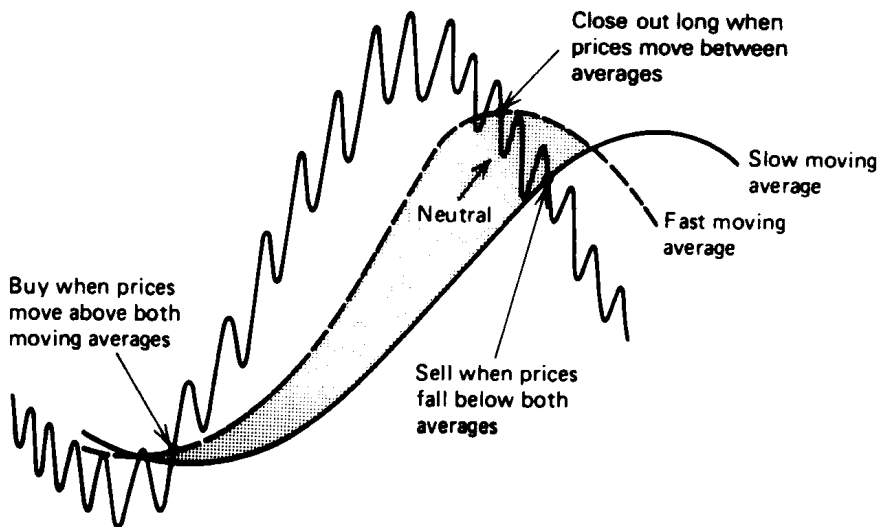
problem with this second approach is that the faster moving average may cause whipsaws by being too close to the current price. This can be solved in the same way as the single moving average by placing a band around one or both of the trendlines. There are other variations of these rules that can be listed, but they are not materially different from these two.

FIGURE 5-8 Sample spreadsheet results for the moving average, exponential, and N-day breakout systems.

Row	Date	Data				Moving Avg				Exponential				N-day Breakout			
		A	B	C	D	E	F	G		E	F	G		E	F	G	H
			High	Low	Close	MA	Dir	Entry		EXP	Dir	Entry		NHigh	NLow	Dir	Entry
6	921231	400.88	396.64	396.64	396.64					396.64							
7	930104	398.72	395.71	396.28						396.58							
8	930105	396.50	394.72	395.65						396.43							
9	930106	396.61	394.37	395.78						396.32							
10	930107	396.68	390.26	391.30		395.13				395.48							
11	930108	391.31	387.30	389.93		393.79		Sell		394.56		Sell		400.88	390.26		Sell
12	930111	391.75	389.61	391.16		392.76				393.99				398.72	387.30		
13	930112	391.72	388.25	391.65		391.96				393.60				396.68	387.30		
14	930113	394.11	390.72	393.50		391.51				393.58				396.68	387.30		
15	930114	396.33	393.36	396.25		392.50		Buy		394.03		Buy		396.68	387.30		
16	930115	400.33	395.75	397.17		393.95				394.55				396.33	387.30		Buy
17	930118	397.47	396.19	397.18		395.15				394.99				400.33	388.25		
18	930119	398.44	394.88	395.92		396.00				395.14				400.33	388.25		
19	930120	397.23	394.01	394.06		396.12				394.96		Sell		400.33	390.72		
20	930121	395.97	392.67	395.51		395.97		Sell		395.05				400.33	393.36		
21	930122	398.11	395.33	396.75		395.88				395.34		Buy		400.33	392.67		
22	930125	400.99	396.75	400.61		396.57		Buy		396.22				398.44	392.67		
23	930126	403.93	400.49	401.14		397.61				397.04				400.99	392.67		
24	930127	401.23	397.70	399.41		398.68				397.43				403.93	395.33		
25	930128	400.69	398.51	400.40		399.66				397.93				403.93	392.67		
26	930129	401.91	399.14	401.57		400.63				398.53				403.93	395.33		
27	930201	404.84	401.57	404.84		401.47				399.59				403.93	396.75		
28	930202	404.84	402.70	404.19		402.08				400.35				404.84	397.70		
29	930203	408.42	404.19	408.02		403.80				401.63				404.84	397.70		
30	930204	410.02	408.02	409.39		405.60				402.92				408.42	398.51		
31	930205	409.69	407.33	409.39		407.17				404.00				410.02	399.14		

FIGURE 5-9 Sample spreadsheet results for the swing breakout and point-and-figure systems.

Row	Date	Data				Swing Breakout						Point-and-Figure					
		A	B	C	D	E	F	G	H	I	J	E	F	G	H	I	J
			High	Low	Close	CurH	CurL	Hill	SwHi	SwLo	Entry	CurH	CurL	Dir	LastH	LastL	Entry
6	921231		400.88	396.64	396.64	400.88	396.64	1	0.00	0.00		200	199	-1	200	0	
7	930104		398.72	395.71	396.28	398.72	395.71	1	0.00	0.00		199	198	-1	200	0	
8	930105		396.50	394.72	395.65	396.50	394.72	1	0.00	0.00		198	198	-1	200	0	
9	930106		396.61	394.37	395.78	396.61	394.37	1	0.00	0.00		198	198	-1	200	0	
10	930107		396.68	390.26	391.30	396.68	390.26	-1	0.00	390.26		195	196	-1	200	0	
11	930108		391.31	387.30	389.93	396.68	387.30	-1	396.68	390.26	Sell	195	194	-1	200	0	
12	930111		391.75	389.61	391.16	391.75	389.61	-1	396.68	387.30		195	194	-1	200	0	
13	930112		391.72	388.25	391.65	391.75	388.25	-1	396.68	387.30		195	194	-1	200	0	
14	930113		394.11	390.72	393.50	394.11	390.72	-1	396.68	387.30		197	194	-1	200	194	
15	930114		396.33	393.36	396.25	396.33	393.36	-1	396.68	387.30		198	197	-1	200	194	
16	930115		400.33	395.75	397.17	400.33	395.75	1	400.33	387.30		200	198	-1	200	194	
17	930118		397.47	396.19	397.18	397.47	396.19	1	400.33	387.30		200	199	-1	200	194	
18	930119		398.44	394.88	395.92	398.44	394.88	1	400.33	387.30		200	198	-1	200	194	
19	930120		397.23	394.01	394.06	397.23	394.01	1	400.33	387.30		200	198	-1	200	194	
20	930121		395.97	392.67	395.51	395.97	392.67	1	400.33	387.30		200	197	-1	200	194	
21	930122		398.11	395.33	396.75	398.11	392.67	-1	400.33	392.67		199	197	-1	200	194	
22	930125		400.99	396.75	400.61	400.99	396.75	-1	400.99	392.67		200	197	-1	200	197	
23	930126		403.93	400.49	401.14	403.93	396.75	-1	400.99	396.75	Buy	201	201	-1	200	197	Buy
24	930127		401.23	397.70	399.41	403.93	397.70	1	403.93	396.75		201	199	-1	200	197	
25	930128		400.69	398.51	400.40	400.69	397.70	1	403.93	396.75		201	200	-1	200	197	
26	930129		401.91	399.14	401.57	401.91	397.70	-1	403.93	397.70	Buy	201	200	-1	200	197	Buy
27	930201		404.84	401.57	404.84	404.84	401.57	-1	403.93	397.70		202	201	-1	200	197	Buy
28	930202		404.84	402.70	404.19	404.84	402.70	-1	403.93	397.70		202	201	-1	200	197	Buy
29	930203		408.42	404.19	408.02	408.42	404.19	-1	408.42	397.70		202	202	-1	200	197	Buy
30	930204		410.02	408.02	409.39	410.02	404.19	-1	408.42	397.70		204	203	-1	200	197	Buy
31	930205		409.69	407.33	409.39	410.02	407.33	-1	408.42	404.19	Buy	205	203	-1	200	197	Buy
32	930208		411.51	408.58	409.62	411.51	408.58	-1	408.42	404.19		205	204	-1	200	197	Buy
33	930209		409.62	406.80	407.78	411.51	406.80	-1	408.42	404.19	Buy	205	204	-1	200	197	Buy
34	930210		408.46	405.77	408.10	408.46	405.77	-1	411.51	404.19		205	204	-1	200	197	Buy
35	930211		410.90	408.10	409.08	410.90	405.77	-1	411.51	405.77		205	203	-1	200	197	Buy
36	930212		409.23	406.26	406.26	410.90	406.26	-1	410.90	405.77		205	204	-1	200	197	Buy
37	930216		406.26	396.38	397.08	406.26	396.38	-1	410.90	396.38		205	199	-1	205	197	Buy
38	930217		397.30	394.34	396.82	406.26	396.38	-1	406.26	396.38	Sell	198	198	-1	205	197	Sell
39	930218		401.01	391.60	396.10	401.01	391.60	-1	406.26	391.60		200	196	-1	205	196	



Donchian's 5 and 20Day Moving Average System

The combined use of two moving averages has been popular among professional advisors. Of these, the most wellknown is Donchian's 5 and 20Day Moving Average,' a method claiming one of the longest recorded operational results, beginning January 1, 1961. There is no explanation for the selection of these two values, but in 1961 when moving averages were considered stateoftheart, they were a reasonable choice. The selections can be justified because of their close relationship to the number of trading days in a week and a month; even now, similar calendar periods might add some desirable features to a system.

Donchian's idea is to use a volatilitypenetration criterion relative to the 20day moving average, but with some added complication. The current penetration must not only cross the 20day moving average but also exceed any previous 1day penetration of a closing price by at least one volatility measure.

The 5day moving average serves as a liquidation criterion (along with others) and is also modified by prior penetration and volatility. These features tend to make Donchian's volatility measurement selfadjusting. Even if selected poorly, the new penetration must exceed prior breakouts; without thorough testing, it may be difficult to determine which rule has more significance. To maintain a human element, Donchian requires execution of certain orders to be delayed a day if the signals occurred on specific weekdays or before a holiday. The combination of different factors is generally the result of refinement over years of actual operation, but neither complexity nor sophistication guarantees success; only the results will tell.

More Than Two Moving Averages

If two moving averages improve trading, it should follow that three or more are even betterbut it doesn't. With the use of two moving averages, there is a main trend identifier and a timing device; the addition of one or

more averages or indicators must fulfill a distinct purpose. When multiple moving averages must agree on the same signal, there is less

'Richard D. Donchian, "Donchian's 5 and 20Day Moving Averages," *Commodities Magazine* (December 1974).

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chance of getting a trading signal and less time holding the trade. The results of moving average systems using two and three moving averages are covered in Chapter 21.

COMPREHENSIVE STUDIES

Because computerized testing programs have made it easy for anyone to test any number of trends in combination, there have been very few comprehensive studies published within the past 10 years. Nevertheless, there is a great deal to learn from putting the results of various systems and markets side by side. Earlier in this chapter there is an informative comparison of six major trending systems; others studies have been included in Chapter 21 ("Testing"). Among them are systems similar to the single and double moving average methods just discussed, as well as the selection of a third trend for entry timing. An important objective of the testing process is the longevity of the parameters selected: this discussion can also be found in Chapter 21.

SELECTING THE RIGHT MOVING AVERAGE'

Up to now, the selection of the right moving average, the one that will work in the future, has only been discussed in general terms. The best moving average speed for a hedger may not be the same as for a speculator. For example, a hedger may be marketing cattle each month and may need to choose a time at which to preprice his or her product. A 3day moving average might generate five sell signals in 1 month, each the result of a 2day price movean ineffective tool for the hedger. The hedger needs an average of one sell signal per month to be a useful timing tool; the speculator has no such concerns.

For the speculator, the right moving average speed is the one that produces the best performance profile. This profile could be simply maximum profits, or it could be a more complex combination of profits, equity variation, and use of margin. In Chapter 21. the computer is used to find the combination of speed, stoploss, and other rules that best satisfies a preset criterion; a computer, however, is not always necessary.

Computer testing of a trend system or other trading strategies sometimes leads to solutions that are highly fitted. The computer may find that a 3day moving average was more profitable with lower risk than a 20day trend, which was only slightly worse in performance. Our logic tells us that the results of the 3day system will be more difficult to attain in real trading, because execution costs in fast markets with many trades may be higher than expected. A slower selection is more conservative and more likely to return the expected results. I orever, the trader must be the judge of whether the selection is reasonable.

A grain trader knows that the seasonal price pattern forms a complete cycle each year. At best we can expect one long upward move followed by a shorter, faster decline. Not all trend speeds can capture the profits in this pattern. For example, if the uptrend lasts for six months, a

6month moving average won't see any of it; therefore, you will need a moving average not much longer than 1/4 of the length of the trend and perhaps shorter. If mass testing of moving averages using an optimizer results in a best moving average period of 6 months, that choice must be understood as a failure of the system to find any shorter period that worked. Selecting theTrend Speed

Observation of a price chart will show the trends of the market. The trends that two traders see will often be different. Some traders immediately focus on longterm price trends:

Perry J. Kaufman, "Moving Averages in Trading Tactics: A Livestock Futures Anthology, Todd Lofton (ed.) (Chicago Mercantile Exchange, Chicago, 1986).

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others see much shorter movements. To find your own best moving average speed without the use of a computer, look at a price chart and mark the beginning and end of each price move that you would like to capture. These trends may occur every few days, or only three or four times each year. In this exercise, the major trends were selected from the chart for August 1985 pork bellies (Figure 511).

Use the fact that a moving average of nday speed will be neutral over a period of n days in which the price returns to the same level. (Remember that a 1year moving average is used to remove the annual seasonal effects.) If the daily price changes are nearly equal, one leg of this move (the trends identified in Figure 55) win occur in n/2 days. To be cautious, select moving average intervals slightly longer than two times the worst retracement within the trend to prevent being stoppedout of the trend.

When calculating profits generated by a moving average, part of the trend movement is lost at the beginning and end of the trade. This part is equivalent to the price change over V, of the moving average period, because it requires that much time for the moving average to break even, or become neutral with respect to the price move.

Keeping these two points in mind, the best trend speed can be selected from presenting the largest moves and largest reversals, as shown in Table 56.

The longest period needed to offset the largest reversal is 3.1 weeks (each week is 5 days), and it takes a 16day moving average to neutralize the largest move. A 16day moving average usually requires 8 days to break even. Allowing 2 weeks (10 days) of price movement to reach the breakeven point, the following profitability remains:

<i>Trade</i>	<i>Move/Week</i>	<i>Profitable Weeks</i>	<i>Total Profit</i>
1	1.30	8	10.4
2	1.25	6	7.5
3	1.40	3	4.2
4	1.70	5	8.5
Total			30.6

Naturally, there will be periods of uncertain direction and small losing

trades with this or any price series; however, capturing these four price trends win go a long way toward profitability

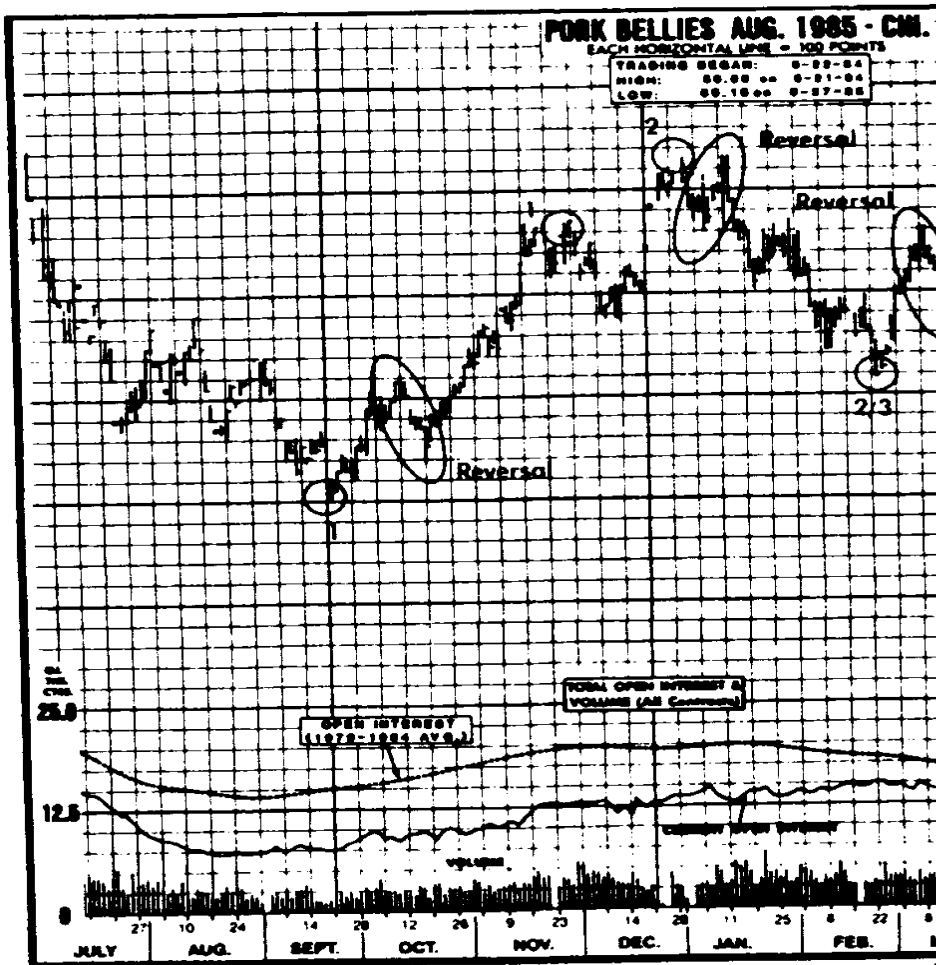
MOVING AVERAGE SEQUENCES: SIGNAL PROGRESSION

Consider the case in which you have selected a 20day moving average to trade. You enter the day with a long bond position and you get a sell signal. However, you don't know because you are not looking, but the 19day and 21 day moving averages did not get sell signals. This means that the day that was dropped off the calculation 20 days ago caused a slight shift not seen by the other neighboring trends. Is this important? Yes .

A moving average is simply a consensus of direction. It is an approximation of values intended to put you on the right side of the market more often than not. It is most fallible at the time prices are changing direction or going sideways. Any information that clears up the problem is helpful. For any moving average system, we would like to see a steady progression of trend change from the short term to the long term. This is seen in the following illustration:

Example E1. Moving Average Period in Days

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Trend	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u	u



Unfortunately, not everything is as uniform as this example. The shorterterm trends can be very erratic, and they often appear in small groups of uptrends and downtrends (see Example E2). This is easily explainable because adding and subtracting 1 day, when only 2, 3, or 4 days are used in the moving average calculation, can quickly change the direction of the trend. As you get to longer intervals, such as 20, 30, and 50 days, this is not the case, and in reality, it doesn't happen often. Yet, when it does, it is clearly an odd case not to be trusted.

TABLE 56 Selecting Trends and Reversals

Trade		Range (cents)	Total Move (cents)	Duration (weeks)
1. Sustained move	up	60-73	13	10
Largest reversal	down	66-62	4	1
2. Sustained move	down	76-66	10	8
Largest reversal	up	73-76	3	1
3. Sustained move	up	66-73	7	5
Largest reversal	down	73-69	4	1
4. Sustained move	down	73-61	12	7
Largest reversal	up	63-67	4	2

*The number of weeks of profitable movement needed to recover the loss due to the largest reversal.

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Example E2. Moving Average Period in Days

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21
Trend u u d d u d u u u u u u u u u u u u d d

There are also cases in which the longer trend begins to reassert itself and the results appear the same as in Example E1; however, the trend change occurs from the longer term down (from right to left instead of left to right). The case we must watch for satisfies neither of these, but occurs in erratic pattern, such as in Example E3. Here we see a dominant longterm uptrend with the very short end turning down. Because of another downturn a few days ago, which then disappeared, this most recent downturn also caused a shadow turn in the 20day range. Is it a leading indicator or a false signal? All indications are that smooth changes in a trend are a more reliable indicator. Another case is given in the second line of Example E3. Here, the smooth trend change from up to down is occurring from left to right; however, as it gets to 13 days, it also jumps ahead to 19 and 20 days, leaving the 14th through 18th days still in an uptrend. Again, we favor the orderly approach and would wait for all trends to change below the one we are using.

Example E3. Unreliable Turns in Trend

<Moving Average Period in Days>

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17
Trend d d d d u u u u u u u u u u u
Trend d d d d d d d d d d d d u u u

An example of this process is shown in Figure 512. Moving average calculation periods of 5 to 50 days are shown in increments of 5

days for a total of 44 consecutive days. This illustration points out how the longterm uptrend (X) is breached by shorterterm, less consistent trends. Perhaps the best trend is the one with the majority of Xs or Os on the same line.

LIVING WITH ATRENDFOLLOWING PHILOSOPHY

The advantages and disadvantages of trend systems are similar to most other types of trading strategies. The first question that a trader should ask is, "What can I expect from a trend approach?" The calculation period of trend will change the profitability, size of individual profits and losses, and reliability. This is covered thoroughly in Chapter 22. Fast trends enter trades on the first strong move following a price reversal; slower averages take more time to identify a trend change. No matter what its speed or how welltimed, a trend signal can never occur at the right point; consequently, watching prices vary with respect to the trendline will be frustrating. The moving average system will rarely enter or close out a position at just the right place; it can only extract profits from the middle of a trend and hold losses to a minimum. The risks and magnitude of reward are intrinsic to the speed of the moving average although the risk/reward ratio may be similar for many moving averages. The success of such a system can only be judged by its actual performance; thus, the weekly or monthly accumulated results should be studied rather than simply observing the relationship of the trendline to prices.

The slower the trend, the further it will lag behind a sustained price move. Professional traders lean toward the faster trends and portfolio managers toward the slower. When trading only one market, individual trade risks can be kept small using faster trends. The portfolio trader can offset the longterm adverse move in one market with an equally long favorable trend in another. The advantage of diversification and longterm trends is that each market will move in the direction of the trend a majority of days, even though that

Day	Moving Average Period									
	5	10	15	20	25	30	35	40	45	50
1	X	X	X	X	X	X	X	X	X	X
2	O	O	X	X	X	X	X	X	X	X
3	O	X	X	X	X	X	X	X	X	X
4	X	X	X	X	X	X	X	X	X	X
5	X	X	X	X	X	X	X	X	X	X
6	X	X	X	X	X	X	X	X	X	X
7	X	X	X	X	X	X	X	X	X	X
8	O	X	X	X	X	X	X	X	X	X
9	X	O	O	O	X	X	X	X	X	X
10	O	O	O	O	O	X	X	X	X	X
11	O	O	O	O	X	X	X	X	X	X
12	O	O	O	O	O	O	O	X	X	X
13	O	O	O	O	X	X	X	X	X	X
14	X	O	O	O	O	O	X	X	X	X
15	O	O	O	O	O	O	O	O	O	X
16	O	O	O	O	O	O	O	O	O	O
17	O	O	O	O	O	O	O	O	O	O
18	O	O	O	O	O	O	O	O	O	O
19	X	O	O	O	O	O	O	O	O	O
20	X	O	O	O	O	O	O	O	O	O
21	X	X	X	O	O	O	O	X	X	X
22	X	X	X	X	O	X	X	X	X	X
23	X	X	X	O	O	O	O	X	X	X
24	X	X	X	X	O	O	O	X	X	X
25	X	X	X	X	O	O	O	X	X	X
26	O	X	X	O	O	O	O	O	O	X
27	O	O	O	O	O	O	O	O	O	O
28	O	O	O	O	O	O	O	O	O	O
29	O	X	X	X	O	O	O	O	O	X
30	X	X	X	X	X	O	O	O	X	X
31	X	X	X	X	X	O	O	O	O	X
32	X	X	X	X	X	X	X	X	X	X
33	X	X	X	X	X	X	X	X	X	X
34	X	X	X	X	X	X	X	X	X	X
35	X	X	X	X	X	X	X	X	X	X
36	X	X	X	X	X	X	X	X	X	X
37	X	X	X	X	X	X	X	X	X	X
38	O	X	X	X	X	X	X	X	X	X
39	O	O	X	X	X	X	X	X	X	X
40	O	O	X	X	X	X	X	X	X	X
41	O	X	X	X	X	X	X	X	X	X
42	X	X	X	X	X	X	X	X	X	X
43	X	X	X	X	X	X	X	X	X	X
44	X	X	X	X	X	X	X	X	X	X

may mean only 6 out of 10. A portfolio of 10 markets, each with a 60% probability of a move in the trend direction, should result in 6 of them moving in a profitable direction. It is more likely that all of them will be profitable on the same day than it is that all will be losers.

Slower trends are more likely to endure than faster ones. These slower trends often profit from fundamental market changes, such as seasonality, production cycles, and inflation. They stick to a trend while it develops. The faster trends are attempting to catch shifts in market psychology, short-term cycles caused by trading patterns and current events, and wide swings in high-priced, uncertain markets. The patterns that make fast trading profitable also change quickly. A 3-day moving average may be highly profitable for one month, then produce consistently losing trades. "Take Your Profits and Let Your Losses Run"

Many traders are guilty of profit-taking using trend systems. Cutting losses short is an intrinsic quality of a trend-based system as is its lag. It is

inevitable that a trader will want to close out a trade that has a \$1,000 profit and a stoploss at a level that captures only \$300. However, this places an arbitrary limit on potential profits while letting losses remain at their natural size. A trendfollowing system compensates for many small losses when prices sustain a large trending move. Don't cut it short.

Using Other Reasons to Exit a Trend Trade

A very longterm trend will often find the direction of the underlying economic fundamentals. For example, a 1year Treasury bond trend would have been long for about five years during the late1980s. Once you understand that the position you are holding is based on a sustained economic situation, you can exit the position when that situation changes. Looking at the Tbond example, prices continued to rise (interest rates fall) to offset slow economic growth and high unemployment. Once the Central Bank (the "Fed") raises rates, it is a good indication that the uptrend is nearly over. Because the very slow trend lags far behind the actual market price, it may be another year before prices cross the trendline and signal a change of position. This is also likely to occur after a large part of your profits have been given back to the market. Exiting the trade when the fundamentals change would be a safe way of capturing more profits and being exposed to less market risk provided the fundamentals are the ones that were driving the market and your profits.